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Authors: Brooks, Daniel M., Sutton, Jack, Kurchez, Laura A., Garside, Adrian, Ejotre, Imran, et al.

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Noteworthy bird records from south-west South Sudan game reserves

by Daniel M. Brooks, Jack Sutton, Laura A. Kurchez, Adrian Garside, Imran Ejotre, Matt Rice, Michelle L. Moeller, Robert J. Harris, Ivan De Klee & DeeAnn M. Reeder

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SUMMARY.—Avian camera trap image data from two game reserves in south-western South Sudan produced three new country records, four other range extensions, and one filled a distributional gap between north-west Ethiopia and eastern Central African Republic. The study took place at Bangangai (31 traps, January 2015–February 2016) and Bire Kpatuos Game Reserves (52 traps, September 2015–August 2017). A total of 40 species (18 families) was recorded, including two Near Threatened species of global conservation concern: Crowned Eagle *Stephanoaetus coronatus* and White-naped Pigeon *Columba albinucha*. The occurrence of Black Goshawk *Accipiter melanoleucus*, Grey-throated Rail *Canirallus oculus* and Nkulengu Rail *Himantornis haematopus* represent first records for South Sudan.

Ornithological studies and baseline biological inventories in present-day south-western South Sudan are sparse due to geographical remoteness, human disease (Ruiz-Postigo 2012) and conflict. Several avian inventories were produced for Bangangai Game Reserve (one of our study sites, see below) during July 1980–January 1983 (Hillman 1983, Hillman & Hillman 1983, 1986). These were compiled while the Hillmans were studying Lowland Bongo *Tragelaphus eurycerus* and other large mammals for the New York Zoological Society (now the Wildlife Conservation Society). Hillman (1983) compiled a list of avian species for the region including the records of Woodman (1936, 1952a,b), Cave & MacDonald (1955), Nikolaus (1979) and Traylor & Archer (1982), all of which were incorporated into the atlas of Sudan birds by Nikolaus (1987).

Given limited avian inventory work in south-western South Sudan during the last four decades, our objectives here are to document new country records and range extensions, as well as fill distributional gaps, resulting from camera trap images of birds as part of survey work in regional game reserves. Such information, which derives from studies focused on other taxa (especially large mammals), is useful for documenting rare avian species in poorly known regions (Brooks *et al.* 2018). Moreover, the methodology is valuable for very shy or cryptic species that might otherwise go unrecorded (O'Brien *et al.* 2003).

Methods

Study region.—This work was undertaken in Bangangai (171 km², centred on 04°57'N, 27°89'E; c.700 m) and Bire Kpatuos Game Reserves (70 km², 04°57'N, 27°87'E; c.700 m), in extreme south-west South Sudan, bordering Democratic Republic of the Congo (DRC) and Central African Republic (CAR) (Fig. 1), and which are separated by 32 km. Bangangai experiences greater levels of human activity associated with bushmeat harvesting due to proximity of the nearest town, Ezo, whereas Bire Kpatuos is more remote and buffered from

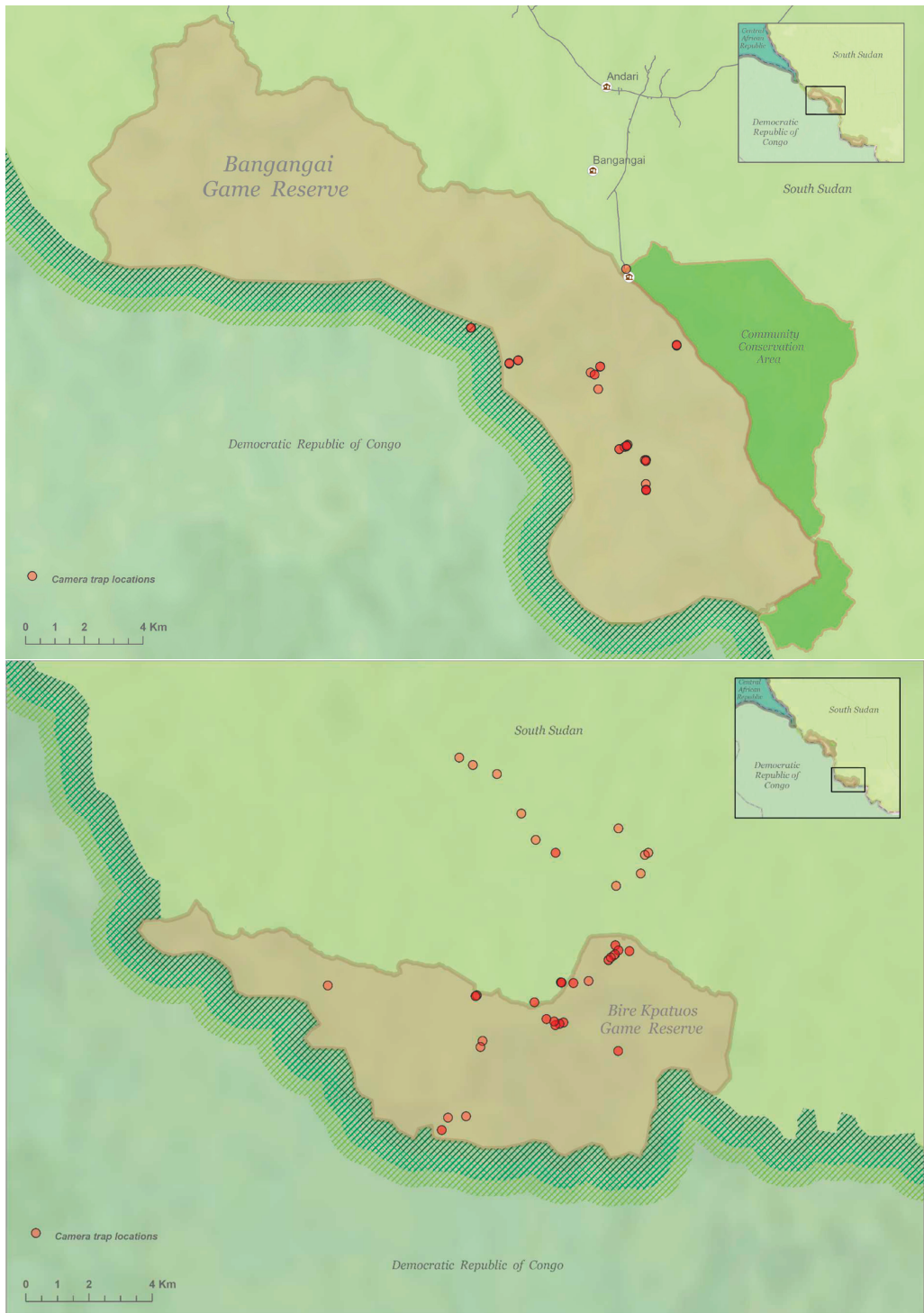


Figure 1. Maps showing locations of camera traps in the study sites at Bangangai (centred on 04°57'N, 27°89'E) and Bire Kpatuos (04°57'N, 27°87'E) Game Reserves, South Sudan.

human settlements by a non-native teak *Tectona grandis* forest concession (Ombina 2008); at the time of our field work it was a c.12 km-walk from the nearest main road. Habitat in both reserves is a mosaic of small patches of primary forest and larger areas of secondary forest surrounded by open savanna, probably created and maintained by annual human-started fires (Hillman 1983). Human communities no longer inhabit the reserves permanently but harvest resources in them. The dry season extends from late November to late April, with the wet season in May to mid November (Hillman 1983).

Camera trap surveys.— A total of 83 Bushnell HD ‘trophy cam’ were deployed, with GPS coordinates recorded manually using Garmin eTrex 10 Handheld GPS. Each camera trap was digitally recorded with a name assigned (e.g., ‘Camera Trap 01A’) and stamped with time and date; if a camera was deployed more than once it was renamed (e.g., if ‘Camera Trap 01A’ was redeployed it was renamed ‘Camera Trap 01B’). Thirty-one camera traps were initially deployed and/or redeployed in Bangangai between January 2015 and February 2016 (4,467 camera trap nights) and 52 camera traps were deployed in Bire Kpatuos from September 2015 to August 2017 (7,823 camera trap nights). Each camera trap had ‘camera mode’ selected and was formatted to take images with ‘widescreen’ to obtain as much information as possible. Cameras were set to trigger at ten-second intervals between each capture, with ‘night vision mode’ selected during nighttime.

Assessment.— All photos of birds were identified to species using Cave & MacDonald (1955), Stevenson & Fanshawe (2002), van Perlo (2002), Redman *et al.* (2009) and Sinclair & Ryan (2010). Numbers of capture events were tallied for each species. Categories of threat status follow BirdLife International (2022). Species records were compared with Hillman (1983). Significant range extensions were assessed via comparison with range maps in Snow (1978), Nikolaus (1987), Sinclair & Ryan (2010) and Billerman *et al.* (2022); the latter reference is continuously updated for the most current information.

Results

A total of 40 species representing 18 families was recorded (Table 1). Half ($n = 20$) of the records involved ≥ 4 camera trap events. Two of these, Crowned Eagle *Stephanoaetus coronatus* and White-naped Pigeon *Columba albinucha*, are classified as Near Threatened, the rest as Least Concern (Table 1). Thirty-one species (78%) were previously reported by Hillman (1983). Three species (Black Goshawk *Accipiter melanoleucus*, Grey-throated Rail *Canirallus oculus* and Nkulengu Rail *Himantornis haematopus*) are first records for South Sudan, four species (including Black Goshawk) represent range extensions, and one bridges a gap between north-west Ethiopia and eastern CAR (Table 1). With the exception of those shown in Fig. 2, photos of the significant records are not of publishable quality and therefore not included here.

Selected species accounts

WHITE-NAPED PIGEON *Columba albinucha*

Our six records of this Near Threatened species, all from Bangangai in March 2015 (except one on 6 April), are notable. While Hillman (1983) had previously recorded the species at Bangangai Game Reserve, Nikolaus (1989) noted that there are few sightings overall in the country.

TABLE 1

List of 40 species recorded by 83 camera traps in Bangangai Game Reserve (January 2015–February 2016) and Bire Kpatuos Game Reserve (September 2015–August 2017), South Sudan. # = total number of camera trap events. ¹ = new country record for South Sudan not recorded by Hillman (1983). ² = north-westerly range extension, ³ = north-easterly range extension; ⁴ = bridges gap between north-west Ethiopia and eastern Central African Republic (Snow 1978, Nikolaus 1987, Sinclair & Ryan 2010, Billerman *et al.* 2022). ⁵ = Near Threatened (BirdLife International 2022). Nomenclature and taxonomy follow Clements *et al.* (2021).

English name	Scientific name	#
NUMIDIDAE		
Helmeted Guineafowl	<i>Numida meleagris</i>	71
Crested Guineafowl	<i>Guttera pucherani</i>	186
PHASIANIDAE		
Stone Partridge	<i>Ptilopachus petrosus</i>	1
Latham's Francolin	<i>Peliperdix lathamii</i>	13
Heuglin's Spurfowl	<i>Pternistis icterorhynchus</i>	10
COLUMBIDAE		
White-naped Pigeon ⁵	<i>Columba albinucha</i>	6
Red-eyed Dove	<i>Streptopelia semitorquata</i>	39
Blue-spotted Wood Dove	<i>Turtur afer</i>	5
Tambourine Dove	<i>Turtur tympanistris</i>	6
African Green Pigeon	<i>Treron calvus</i>	42
MUSOPHAGIDAE		
Great Blue Turaco	<i>Corythaeola cristata</i>	62
Eastern Plantain-eater	<i>Crinifer zonurus</i>	2
RALLIDAE		
Grey-throated Rail ^{1,3}	<i>Canirallus oculus</i>	3
Nkulengu Rail ^{1,3}	<i>Himantornis haematopus</i>	8
CICONIIDAE		
African Openbill	<i>Anastomus lamelligerus</i>	1
Black Stork	<i>Ciconia nigra</i>	2
Abdim's Stork	<i>Ciconia abdimii</i>	5
Woolly-necked Stork	<i>Ciconia episcopus</i>	43
SCOPIDAE		
Hamerkop	<i>Scopus umbretta</i>	6
ARDEIDAE		
Black-headed Heron	<i>Ardea melanocephala</i>	21
Striated Heron	<i>Butorides striata</i>	1
ACCIPITRIDAE		
European Honey Buzzard	<i>Pernis apivorus</i>	1
Palm-nut Vulture	<i>Gypohierax angolensis</i>	35
African Harrier-hawk	<i>Polyboroides typus</i>	12

African Goshawk	<i>Accipiter tachiro</i>	4
Black Goshawk ^{1,2}	<i>Accipiter melanoleucus</i>	1
Little Sparrowhawk ²	<i>Accipiter minullus</i>	1
Long-tailed Hawk	<i>Urotriorchis macrourus</i>	6
Crowned Eagle ^{4,5}	<i>Stephanoaetus coronatus</i>	14
STRIGIDAE		
African Wood Owl	<i>Strix woodfordii</i>	2
BUCEROTIDAE		
Black-casqued Hornbill	<i>Ceratogymna atrata</i>	8
Black-and-white-casqued Hornbill	<i>Bycanistes subcylindricus</i>	2
ALCEDINIDAE		
Blue-breasted Kingfisher	<i>Halcyon malimbica</i>	2
Woodland Kingfisher	<i>Halcyon senegalensis</i>	4
MEROPIIDAE		
Black-headed Bee-eater	<i>Merops breweri</i>	3
PYCNONOTIDAE		
Common Bulbul	<i>Pycnonotus barbatus</i>	2
TURDIDAE		
African Thrush	<i>Turdus pelios</i>	1
MUSCICAPIDAE		
Snowy-crowned Robin-chat	<i>Cossypha niveicapilla</i>	2
PLOCEIDAE		
Yellow-mantled Widowbird	<i>Euplectes macroura</i>	1
ESTRILDIDAE		
Magpie Mannikin	<i>Spermestes fringilloides</i>	1

GREY-THROATED RAIL *Canirallus oculeus*

Photographed in Bangangai on 24 May and 8 July 2015, at 17.32–18.52 h. These records, the first for South Sudan, extend the range c.150 km north-east (Snow 1978, Sinclair & Ryan 2010, Taylor 2020a). The nearest known record is from Medje, Rungu, DRC (02°23'N, 27°18'E; Schouteden 1963).

NKULENGU RAIL *Himantornis haematopus*

Five records at Bangangai and three at Bire Kpatuos, in all months except August–October. Activity peaked at dusk, with 62% ($n = 5$) of records during 18.10–18.50 h. These eight records are the first for South Sudan, and extend the range c.175 km north-east (Snow 1978, Taylor 2020b). The nearest known record is from Medje, Rungu, DRC (02°23'N, 27°18'E; Schouteden 1963).

BLACK GOSHAWK *Accipiter melanoleucus*

Photographed at Bangangai on 26 August 2015 at 11.08 h. This record is the first in South Sudan and extends the species' range c.150 km north-west (Snow 1978, Sinclair & Ryan 2010, Kemp & Kirwan 2020).



Figure 2. Camera trap voucher images of Long-tailed Hawk *Urotriorchis macrourus* (24 April 2015, above) and Crowned Eagle *Stephanoaetus coronatus* (19 February 2013, below) from Bire Kpatuos and Bangangai Game Reserves, respectively, South Sudan.

LITTLE SPARROWHAWK *Accipiter minullus*

Photographed at Bire Kpatuos on 8 October 2015, which extends the range c.40 km north-west (Snow 1978, Nikolaus 1987, Sinclair & Ryan 2010, Kemp & Marks 2020).

LONG-TAILED HAWK *Urotriorchis macrourus*

Two records, one each at Bire Kpatuos and Bangangai (Fig. 2) on 24 April and 28 August 2015, respectively. While Hillman (1983) recorded the species at Bangangai Game Reserve,

Nikolaus (1989) mentioned only a few sightings in the country, making these records notable.

CROWNED EAGLE *Stephanoaetus coronatus*

Nearly all records ($n = 13$) were from Bangangai ($n = 1$ at Bire Kpatuos), spanning 22 January–26 November 2015. The 14 records of this Near Threatened species (Fig. 2) bridge a range gap between north-west Ethiopia and eastern CAR (Kemp *et al.* 2020). Bowen (1926) recorded this species in north-west South Sudan at Bahr el Ghazal. Nikolaus (1987) reported it from the Imatong Mountains based on his own observations, and later (Nikolaus 1989) accepted other unreferenced records from elsewhere.

Discussion

Three species detected in this study represent new country records and four are range extensions, while another bridges a gap between eastern CAR and north-west Ethiopia (Table 1), reflecting the lack of survey work in South Sudan. Indeed, this landscape has been dubbed the 'African Pole of Inaccessibility' due to its remoteness, poor road access and persistent insecurity (Ondoua *et al.* 2017).

Many of the species in Table 1 are at the north-west or north-east limit of their geographic distributions. Indeed, our study sites are situated at the ecotone between Congo Basin forests and Sudan savanna to the north / north-east, along the border of South Sudan with DRC and CAR. The location of this belt in the Congo Basin ecoregion sets it apart from the rest of South Sudan, forming part of the zone of overlap with fauna and flora from Central and East Africa, and therefore harbours exceptional biodiversity. These game reserves are an important part of the watershed between the Nile and Congo Rivers.

Our discovery of Grey-throated and Nkulengu Rails, which were not reported by Hillman (1983), is likely to reflect the advantage of using camera traps to detect these shy species (O'Brien *et al.* 2003, Brooks *et al.* 2018). Indeed, relatively little is known about Nkulengu Rail, but our findings are concordant with Taylor (1998) that the species appears to be largely sedentary, occurring in all months except August–October, and is most active crepuscularly, with records during the period 18.10–18.50 h. Noteworthy natural history observations can be gleaned for other species as well. For example, that most White-naped Pigeons records were in March perhaps reflecting that the species visits masting trees during this period, despite moving over large areas otherwise (Gibbs *et al.* 2001).

Multiple records were made of two Near Threatened species, Crowned Eagle ($n = 14$ events) and White-naped Pigeon ($n = 6$). While the primary threat to these species is forest clearance (BirdLife International 2022), the number of records points to the healthy condition of forest in the reserves. Indeed, our work has demonstrated an increase in forest cover in both reserves between 1985 and 2011 (Kurpiers 2015) despite significant habitat loss elsewhere in the region (UNEP 2007). As evidenced by the exceptional mammal diversity documented by our camera trap study (Sutton 2020), these forests support several prey species of Crowned Eagle (e.g., Red-tailed Monkey *Cercopithecus ascanius* and other Cercopithecidae) for example.

For decades, civil conflict made these dense forests difficult to monitor. The reserves are now being managed via a partnership between the national wildlife service and Community Wildlife Ambassadors. This ensures a cooperative system of wildlife monitoring and law enforcement between the government and local communities, with support from Fauna & Flora International in partnership with Bucknell University. Recommended conservation actions today remain much the same as elucidated by Hillman (1983): maintain wildlife ranger presence in the reserves, manage illegal bushmeat hunting and timber extraction,

and manage fires within the reserves. To this list we would add engagement of surrounding communities, locally led species monitoring, and establishment of locally managed community conservancies.

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Addresses: Daniel M. Brooks, Houston Museum of Natural Science, Dept. of Vertebrate Zoology, 5555 Hermann Park Drive, Houston, TX 77030-1799, USA, e-mail: dbrooks@hmns.org. Jack Sutton, South Sudan Diversity Cam Project, c/o Dept. of Biology, Bucknell University, 1 Dent Drive, Lewisburg, PA 17837, USA, e-mail: jsutton11194@gmail.com. Laura A. Kurchez, Dept. of Biology, Bucknell University, 1 Dent Drive, Lewisburg, PA 17837, USA, e-mail: laura.kurpiers@gmail.com. Adrian Garside, Dept. of War Studies, King's College London, Strand, London WC2R 2LS, UK, e-mail: adrian.garside@kcl.ac.uk. Imran Ejotre, Dept. of Biology, Muni University, 3km off Arua-Muni Road, P.O Box 725, Arua, Uganda, e-mail: i.ejotre@muni.ac.ug. Matt Rice, Conserve Global, 64 New Cavendish Street, London W1G 8TB, UK, e-mail: matt.jh.rice@gmail.com. Michelle L. Moeller, Fauna & Flora International, The David Attenborough Building, Pembroke Street, Cambridge CB2 3QZ, UK, e-mail: michelle.moeller@fauna-flora.org. Robert J. Harris, WWF Tanzania, 6 Kiko Street, Mikocheni, Dar es Salaam, Tanzania, e-mail: rharris@wwftz.org. Ivan de Klee, Nattergal Ltd., Boothby Wildland, Boothby Pagnell, Grantham, Lincolnshire NG33 4DE, UK, e-mail: ivan.deklee@nattergal.co.uk. DeeAnn M. Reeder, Dept. of Biology, Bucknell University, 1 Dent Drive, Lewisburg, PA 17837, USA, e-mail: dreeder@bucknell.edu